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मानक

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IS 2167 (1983): Specification for Bottle coolers [MED 3: Refrigeration and Air Conditioning]



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Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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Indian Standard

(Reaffirmed 2001)

SPECIFICATION FOR
BOTTLE COOLERS

(First Revision)

1. Scope — Prescribes the general constructional requirements and methods of testing and rating dry type self-contained bottle coolers operated by electrically driven vapour compression type refrigerating machine with air-cooled condenser.

2. Terminology — For the purpose of this standard, the following definitions shall apply.

2.1 Bottle Cooler — A machine to cool and dispense bottled drinks.

2.2 Bottle Opener — A device fixed at a convenient place to the bottle cooler for purposes of moving the caps of bottles.

2.3 Dispenser — A suitable arrangement to hold fresh or empty bottles for the ready use of the vendor or customer.

2.4 Dry Type Self-Contained Bottle Cooler — One which uses air, rather than water, as the cooling medium in the refrigerated storage space.

2.5 Vapour Compression Cycle — A refrigeration cycle in which a volatile liquid absorbs heat, evaporates and is compressed to a higher pressure and temperature to return to its liquid state again, by rejecting heat at a higher temperature and pressure.

2.6 The Average Cabinet Air Temperatures — The average air temperature taken by means of the thermocouples or thermometers located at places in the cabinet as shown in Appendix A at any point of the thermostatic cycle.

2.7 Cycles per 24 Hours — A cycle in the operation of a bottle cooler is the period during which a compressor goes through the steps of starting, running, stopping and starting again. Cycles per day can be determined by dividing the number of complete cycles by the elapsed time in hours and multiplying the result by 24.

2.8 Percentage Running Time — The percentage running time, under given conditions of ambient temperatures and of mean internal temperature, is the ratio:

$$R = \frac{d}{D} \times 100$$

where

d = duration of compressor operation during a full number of cycles, and

D = total duration of the cycles.

2.9 Overall Dimensions — Measurement of the outside rectangular dimensions over the horizontal base within which the bottle cooler including the accessories other than bottle opener and handle are inscribed.

2.10 Gross Volume — Total volume contained within interior walls of the cabinet with the door closed and determined by the method given in 4.3.

2.11 Storage Volume — The total volume contained inside the cabinet for storage of bottles. This will be equal to the gross volume minus volume of internal fittings as described in 4.4.

2.12 Bottle Storage Capacity — The total number of standard 190 ml beverage bottles that can be loaded inside the cabinet. In addition, this may also be expressed in terms of number of standard 650 ml beer bottles.

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3. Construction

3.1 General Design — The cabinet and their parts shall be constructed with strength and rigidity adequate to withstand normal conditions of handling, transport and usage. Where an internal light is fitted, the lamp shall be effectively protected from mechanical damage but shall be accessible without excessive dismantling. There shall be no sharp edges or corners liable to cause injury to the user in the normal conditions of use.

3.2 Materials — Materials used in the construction of the cabinet shall comply with Indian Standards wherever applicable, except where such requirements are modified by this standard. They shall be free from defects which are liable to cause undue deterioration or failure. Under normal conditions of use, the materials used shall not shrink, warp or cause odour and shall be resistant to attack by local vermins and destructive pests. Sealing materials used shall not become loose in service any of their essential properties, such as adhesiveness, plasticity and moisture resistance, due to ageing, temperature and humidity variations.

3.3 Finish — The interior and exterior finish shall be durable and capable of being cleared effectively and hygienically without undue deterioration. All metal parts used inside or outside the cooler which are exposed to moisture or ambient conditions shall be corrosion resistant or adequately protected against corrosion.

3.4 Thermal Insulation — The quality, thickness and application of the insulating material shall be such as to maintain the required temperature inside the cabinet. There shall be proper seals against moisture penetration by diffusion or condensation. Detachable plates and covers in the cabinet shall be provided with suitable seals to prevent ingress of moisture into the insulation. External surfaces of the cabinet shall be free from moisture condensation under normal conditions of service.

3.5 Fittings — Linings and facing shall have sufficient mechanical strength to resist distortion and give reasonable protection to the insulation. When the lids of the refrigerated space are closed, there shall be no leakage of external air into the cabinet either past the lid gaskets or by any other means.

3.6 Hardware — Lid fasteners and hinges shall be smooth and positive in action and designed to maintain their proper function without undue wear under normal conditions of service. Screws and all other hardware shall be of corrosion resisting material.

3.7 Refrigeration System

3.7.1 Construction — The pipes and connections to moving or resiliently mounted parts shall be arranged so as not to foul with or transmit vibration to other parts. The pipes and connections shall be securely fixed and should be of sufficient length to minimize the risk of failure due to vibration. The refrigerating system shall not have distinct nuisance noise in the normal running operation and should not transmit vibration to adjoining portions of the surroundings. Where necessary pipes and valves shall be properly insulated.

3.7.2 Safety features in design — The refrigerating system shall be assembled in accordance with good engineering practice. The refrigerating system shall be so designed that it will suffer no damage if the lid of the cabinet is left open accidentally for a short duration in ambient air of the specified temperature. During this period motor overload protective device may come into operation.

3.7.3 Control of operations — Refrigerant flow and compressor motors shall be automatically controlled to reduce the cabinet temperature to the temperature specified and to maintain it within the limits of applications. Suitable strainer shall always be provided in the liquid line.

3.7.4 Location of components — The evaporator, screen and shelves shall not obstruct access to the stored bottles. All control devices and service valves shall be readily accessible.

3.7.5 Strength of pressure parts — The parts of the refrigerating circuit subjected to internal pressure shall be perfectly tight. They should be designed to withstand without permanent deformation and leakage the pressure given in Table 1.

3.8 Electrical Components

3.8.1 All ratings shall be based on either 230 or 240 volts in the case of single phase supply and either 400 or 415 volts in the case of 3 phase supply. The unit, however, shall be capable of working at any voltage within ± 10 percent of the rated voltage.

TABLE 1 TEST PRESSURE
(Clause 3.7.5)

Refrigerant	Pressure (Gauge)
Chlorodifluoromethane (R-22)	28.0 bar
Dichlorodifluoromethane (R-12)	17.0 bar

Note — When a system is such that its low side pressure cannot by reasons of its design, go beyond a maximum pressure of P_m , the test pressure shall be $P_m \times 1.3$ provided such pressure does not exceed that shown in table.

3.8.2 Electric motors — Electric motors for hermetically sealed compressors shall be so constructed that the constant pressure of oil and refrigerant under working pressure and temperature has no adverse effect on the insulation material and windings.

3.8.3 Compressor motor overload protector — The compressor motor shall be connected through a current and temperature sensitive protecting device which is capable of automatically disconnecting the motor from the line in case the motor is electrically or thermally overloaded either during starting or running.

3.8.4 Electrical contacts — Electrical contacts in relays and thermostats should be of snap action type and shall be of ample capacity to easily handle the locked rotor current, that is, the continuous current taken by the motor when its rotor is mechanically locked so as to prevent its rotation.

3.8.5 Flexible cord — Three-core cable conforming to IS : 434 (Part 1)-1964 'Specification for rubber-insulated cables: Part 1 with copper conductors (*revised*)' or IS : 694-1977 'Specification for PVC insulated cables for working voltages up to and including 1 100 V (*second revision*)' of at least 1.5 metres length shall be provided with each unit. A three-pin plug and starter, if required, shall be provided at the time of installation.

3.8.6 Wiring — Electrical wiring and connections shall conform to the requirement of IS : 732-1963 'Code of practice for electrical wire installations (system voltage not exceeding 650 V) (*revised*)' and also to the Indian Electricity Act, 1910 and Indian Electricity Rules 1956. All electrical joints shall be electrically and mechanically secure.

3.8.7 Accidental contact — Live parts shall be protected by suitable guards, shields or screens of adequate strength and durability to avoid the possibility of making inadvertent contact therewith during normal service conditions.

3.8.8 Electrical accessories — All internal electrical fittings, such as lamps, and switches, shall be provided with guards for protection against mechanical damage and shall be suitable for operation at the lowest air temperature likely to occur.

3.8.9 Terminals — The materials, design and proportions of all terminals shall be such that connections made shall not slacken or overheat under the normal conditions of use. Terminals shall be such that conductors connected thereto are rigidly and effectively clamped between metal surfaces. Terminal screws and nuts shall engage for atleast two full turns.

4. Measurement of Bottle Cooler Storage Capacity

4.1 Accuracy of Measurement and Units — Linear dimensions shall be measured to the nearest millimetre. Areas estimated shall be expressed in square decimetres. Volumes estimated shall be expressed in cubic decimetres or litres.

4.2 Inside Dimensions of the Cabinet

4.2.1 Front access type

4.2.1.1 Inside depth — This shall be the mean horizontal distance between the front and the rear inside surface of the enclosed space of the cabinet.

4.2.1.2 Inside width — This shall be the mean horizontal distance between the inner surfaces of the side walls of the enclosed space.

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4.2.1.3 Inside height — This shall be mean vertical distance between the inner surfaces of the floor and the ceiling of the enclosed space.

4.2.2 Top access type

4.2.2.1 Inside depth — This shall be the mean horizontal distance between the front and rear inner surfaces of the front and back walls of the enclosed space of the cabinet.

4.2.2.2 Inside width — This shall be the mean horizontal distance between the inner surface of the side walls of the enclosed space.

4.2.2.3 Inside height — This shall be the mean vertical distance between the inner surface of the floor and the lids.

4.3 Gross Volume — The gross volume of the bottle cooler shall be the product of inside depth, inside width and inside height as defined in 4.2.1 and 4.2.2.

4.4 Storage Volume (Net Volume) — The storage volume shall be the gross volume or sum of the gross volumes of individual compartments less the volumes of internal fittings fixed in the cabinet and the volumes of the shelves and partitions essential for the proper operation of the cabinet, provided each part is more than 0.25 litre.

4.5 Volume of Shelves, Partitions and Internal Fittings — The volume of a shelf, partition or internal fitting shall be the product of its area and thickness. The area of a shelf shall be the product of its width and depth. Where part of the shelf is cut away, the area of the cut-out shelf shall be deducted. Where the edge of the shelf is not more than 25 mm from the cabinet lining, the shelf shall be considered as extending to the lining for the purpose of calculating shelf area. Where there is an access door in a wall of the cabinet the inner surface of the door shall be considered as being the inner surface of the lining.

4.5.1 The thickness of the shelves and partitions shall be the distance between the outer surface excluding the edges, where those are reinforced (see Fig. 1). Where surfaces are corrugated or fitted with pipe grids, the plane through the apices of the corrugations or pipes shall be used for calculating volumes except that where the door distance between adjacent corrugations or pipes is greater than 100 mm the surface itself shall be used and a volume shall be deducted for each corrugation or pipe equal to the product of the width, the distance from the surface to the outside of the corrugation or pipe and the length of the corrugation of pipe.

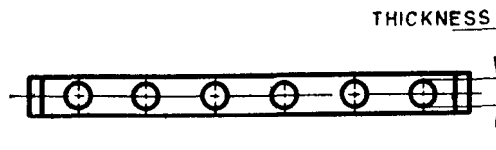


FIG. 1 THICKNESS OF SHELVES

4.6 Full Partitions — The volume of a full partition is the product of its thickness, depth and width or height. This depth, width and height are those dimensions of the cabinet applicable in the place of partition.

4.7 Fractional Partitions — The volume of a permanently fixed fractional partition is the product of its thickness, depth and width or height whichever of these two is applicable. The depth, width or height are the distances normal to the lining from adjacent surfaces to the further edges of the partitions or to the evaporator in case the fractional partition touches it. A horizontal partition the edges of which are more than 70 mm from the lining of the cabinet is regarded as fractional partition. A vertical partition, the edges of which are more than 100 mm from the lining of the cabinet, is regarded as a fractional partition.

4.8 Rated Gross Volume — This shall be the gross volume as declared by the manufacturer in cubic decimetres or litres. The measured gross volume as described in 4.3 shall not be less than the rated gross volume by more than 5 percent.

4.9 Rated Storage Volume — This shall be the storage volume as declared by the manufacturer in cubic decimetres or litres. The measure storage (net) volume as described in 4.4 shall not be less than the rated storage volume by more than 5 percent.

4.10 Rated Bottle Storage Capacity — This shall be the storage capacity as declared by the manufacturer in terms of number of standard 190 ml beverage bottles. In addition storage capacity in terms of number of standard 650 ml bottles may also be declared by the manufacturer. The actual bottle storage capacity shall not be less than rated bottle storage capacity by more than 5 percent.

5. Tests

5.1 Type Tests — The following shall constitute the type test:

- a) Thermal insulation test,
- b) Insulation resistance test,
- c) High voltage test,
- d) No load performance test,
- e) Percentage running time test,
- f) Capacity rating test, and
- g) Maximum operating condition test.

5.1.1 Once a bottle cooler has undergone type test any major alterations affecting the performance which the manufacturer intends to make in the bottle cooler shall be reported to the testing authority recommended by ISI and further type test shall be carried out in the modified bottle cooler in accordance with the procedure laid down in this standard (see 5.7).

5.2 Production Routine Tests — Every bottle coolers, after completion shall be subjected to the following routine tests:

- a) Insulation resistance test.
- b) Performance test, and
- c) High voltage test.

5.2.1 The manufacturer shall furnish with each bottle cooler a certificate that the production routine tests specified in 5.2 have been conducted in accordance with the prescribed procedure (see 5.8) and that the unit conforms to the requirement of this standard.

5.3 Acceptance Tests — If the purchaser desires any of the production routine tests to be repeated at the time of purchase then, where agreed to between the purchaser and the manufacturer, the tests shall be carried out at the manufacturer's works, alternatively, the test may be repeated at a place specified by the purchaser provided all the arrangements for tests are made by the purchaser at the specified place.

5.4 Sample for Tests

5.4.1 Type tests — Two bottle coolers of each type and size shall be sent along with manufacturer's detailed specifications to the appropriate testing authority for purposes of type tests. Type tests can be performed by the manufacturer himself if approved by the purchaser.

5.4.2 Acceptance tests — The number of samples shall be as agreed to between the purchaser and the manufacturer.

5.5 Preparation and Test Conditions for Type Tests

5.5.1 Each specimen tested shall be selected from stock or routine factory production, and shall be representative of construction and adjustments.

5.5.2 The bottle cooler with all panels and lids in place, shall be tested in a room in which the temperature can be controlled. Panels and lids should remain in place throughout the entire test.

5.5.3 Bottle coolers shall be operated until stable operating conditions are reached. The stable conditions are deemed to have reached when during a time of 2 hours the average cabinet air temperature does not vary by more than 0.5°C.

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5.5.4 The bottle cooler being tested shall be located in a room so that its temperature is not affected by direct radiation to or from external cooling or heating equipment. The air circulation in the room shall be such that the specified uniformity of ambient temperature is obtained without direct draft upon the bottle cooler under test.

5.5.5 The fan motor and compressor shall be so connected as to facilitate measurement of the power input. When tested under actual working conditions the fan motor should conform to the requirements specified in IS : 996-1979 'Specification for single phase small ac and universal electric motors (second revision)'.

5.5.6 For the test during which the bottle cooler will be in operation, electric power supply shall not vary by more than ± 2 percent of the rated voltage.

5.5.7 Bottles shall be filled with either beverage liquid or water. Alternatively suitable brine solution may be used if there is any likelihood of temperature falling to 0°C or less.

5.5.8 Bottle temperature shall be measured by thermocouple located approximately at the centre of the mass of the liquid in the bottle. Bottles shall be corked with provision for bringing the thermocouple leads out through the cork.

5.5.9 For determination of average bottle temperature, liquid temperature should be measured in bottles located at uniformly interspread points inside the cabinet, including measurement in top layers and one measurement in the bottom layer of bottles. Apart from these two locations, additional bottles should be based on approximately one bottle per 100 to 150 litres of storage volume.

5.6 Instruments

5.6.1 Temperature measurements shall be made with one or more of the following instruments:

- a) Mercury-in-glass thermometer,
- b) Alcohol-in-glass thermometer,
- c) Thermocouples,
- d) Electric resistance thermometers, or
- e) Electric resistance measurements instruments having accuracy 0.2 percent of the scale.

5.6.1.1 Accuracy of measurement shall be within $\pm 0.5^{\circ}\text{C}$.

5.6.2 Electrical measurements shall be made with indicating instruments.

5.6.2.1 The accuracy of indicating instruments shall be within 1.5 percent of the full scale reading.

5.6.3 The smallest division on the scale of any instrument shall not exceed twice the specified accuracy for it.

5.7 Procedure for Type Tests

5.7.1 Thermal insulation test (external condensation test) — The bottle cooler cabinet shall be held with an average internal temperature between 4°C to 8°C under ambient temperature of $32 \pm 2^{\circ}\text{C}$. It shall be considered satisfactory if, when the relative humidity of the ambient air is held between 70 to 75 percent condensed moisture is not visible on the outer surface of the bottle cooler to the unaided eye of a trained observer during a period of time lasting for 12 hours after the test conditions have become stable.

5.7.2 Insulation resistance test — The insulation resistance between all electric circuits included in the bottle coolers, and earthed metal parts, when measured at normal room temperatures with a voltage of 500 V dc, shall not be less than $1\text{ M}\Omega$ at the end of the maximum operating condition test. This test should be repeated after high voltage test.

5.7.3 High voltage test — The electrical insulation of all electric circuits included in the bottle cooler shall be such as to withstand a high voltage test of 1 000 V rms applied for 2 seconds between all electric circuits and all accessible metal parts (electrically connected together for this test) at normal room temperature. The test voltage shall be alternating, of approximately sine-wave form, and of any convenient frequency between 25 to 100 Hz.

5.7.4 No-load performance test — With the bottle cooler working under no-load and with the thermostat terminals short-circuited, at ambient temperature of $35 \pm 2^\circ\text{C}$, the time required to pull down the average cabinet air temperature from $35 \pm 2^\circ\text{C}$ to 4°C shall not exceed 3 hours.

5.7.5 Percentage running time test — For this test, the cabinet shall be tested on no-load, with lids closed and the thermostat set for maximum cooling. The duration of the test will be 12 hours at an ambient temperature of $35 \pm 2^\circ\text{C}$. Percentage running time will be taken as average of three successive runs in the later half of this period.

5.7.6 Capacity rating test — This test should immediately follow percentage running time without switching off the unit. In case, this is not possible then the unit should run on no-load for a minimum period of 3 hours under prevailing ambient conditions before the start of this test. During the entire test period, the ambient temperature should be maintained at $35 \pm 2^\circ\text{C}$ and thermostat should be set for maximum cooling. Unit should be loaded with specified number of standard 190 ml bottles at an initial temperature of $30 \pm 2^\circ\text{C}$. Rate of loading of bottles should not be less than 10 bottles per minute. Once the loading is over, lids should be properly closed. The test duration starts from the moment the lids are closed. Bottle temperatures should be recorded every 30 minutes for specified pull down period which shall not exceed 12 hours. Average temperature of bottles at the end of specified pull down period shall not be greater than 5°C , and the maximum bottle temperature shall not exceed 8°C .

5.7.7 Maximum operating conditions test — This test should immediately follow capacity rating test without switching off the unit. In case this is not possible the unit should run on no-load for a minimum of 3 hours under prevailing ambient conditions before the start of this test. During the entire test period the ambient temperature should be maintained at $43 \pm 2^\circ\text{C}$ and the thermostat should be set for maximum cooling. Unit should be loaded with specified number of standard 190 ml bottles at an initial temperature of $35 \pm 2^\circ\text{C}$. Rate of loading of bottles should not be less than 10 bottles per minute. Once the loading is over, lids should be properly closed. The test duration starts from the moment the lids are closed. Bottle temperatures should be recorded every 30 minutes for specified pull down period which shall not exceed 18 hours. Average temperature of bottles at the end of specified pull down period shall not be greater than 5°C and the minimum bottle temperature shall not exceed 8°C .

Note — Unit may trip on overload protector during initial stage of the test. This should be considered as permissible.

5.7.8 The type test report shall also contain the following identification data:

- a) Name-plate data of bottle cooler,
- b) Name-plate data of compressor, and
- c) Name-plate data of fan motor.

5.8 Procedure for Production Routine Tests

5.8.1 Insulation resistance test — Electrical insulation test shall be carried out at 500 V dc, given in 5.7.2 at the end of performance test.

5.8.2 Performance test — This test should be carried out with thermostat short-circuited externally (or thermostat bulb pulled out from its housing) under prevailing ambient condition provided ambient temperature is not less than 25°C . In case ambient is less than 25°C the provision of suitable heating arrangement should be incorporated in the test area to create higher ambient temperature. Measurement shall be made of the following and the performance figure shall be compared with the unit which has already passed the type test:

- a) Ambient temperature,
- b) Initial average cabinet temperature on no-load,
- c) Average cabinet temperature at the end of specified pull-down period,
- d) Current, and
- e) Voltage.

Duration of the test should not exceed 3 hours. During this test a single thermometer may be used to measure cabinet temperature, with its bulb at least 150 mm from any walls or bottom.

After pull down, the machine should be continued to run with thermostat adjusted for minimum specified temperature for a period of at least 3 hours. During this period operation of the unit should be satisfactory and thermostat should operate correctly.

Note — Minimum specified cabinet temperature should not be greater than 4°C when operating at an ambient temperature of $35 \pm 2^\circ\text{C}$.

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5.8.3 High voltage test — The electrical insulation of all electric circuits included in the bottle cooler shall be such as to withstand a high voltage test of 1 000 V rms applied for 2 seconds between the electric circuits and all accessible metal parts (electrically connected together for this test) at normal room temperature. The test voltage shall be alternating of approximately sine-wave form, and of any convenient frequency between 25 and 100 Hz.

6. Manufacturer's Certificate — The manufacturer shall furnish with each bottle cooler a copy of the type test certificate, if required by the customer, and shall also certify that the bottle cooler has been manufactured according to the type tested by the testing authority and that it conforms to the requirements of this standard.

6.1 The manufacturer's certificate shall not be necessary unless specifically demanded by the customer if the bottle cooler bears the ISI Certification Marks (see 7.1.1)

7. Marking and Information

7.1 Each bottle cooler shall have the following information marked in a permanent and legible manner in a location where it is easily accessible and easily visible after installation:

- a) Name-plate data of bottle cooler including make, model and serial number of the unit and the name and quantity of refrigerant,
- b) Supply characteristics,
- c) Capacity in terms of litres of storage volume;
- d) Wiring diagram, and
- e) Full load current.

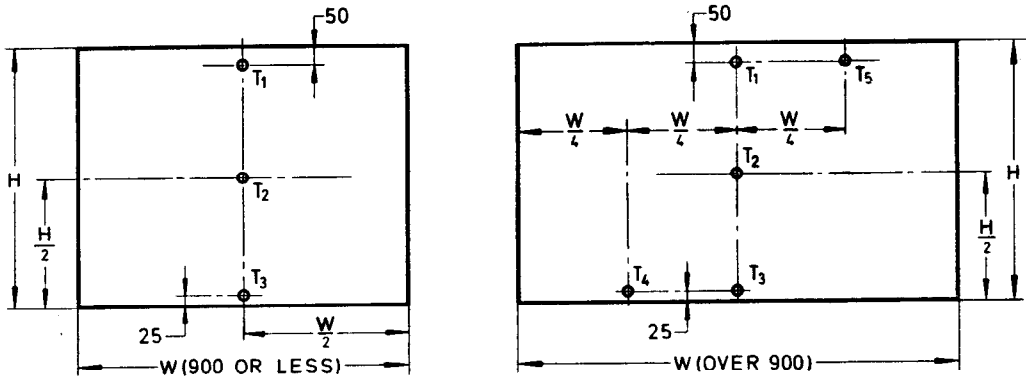
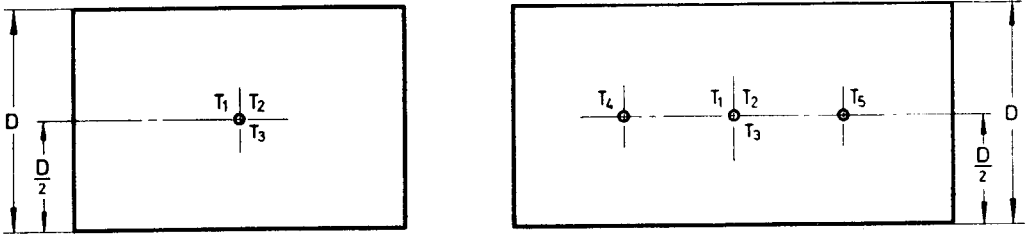
7.1.1 Certification Marking — Details available with the Bureau of Indian Standards.

EXPLANATORY NOTE

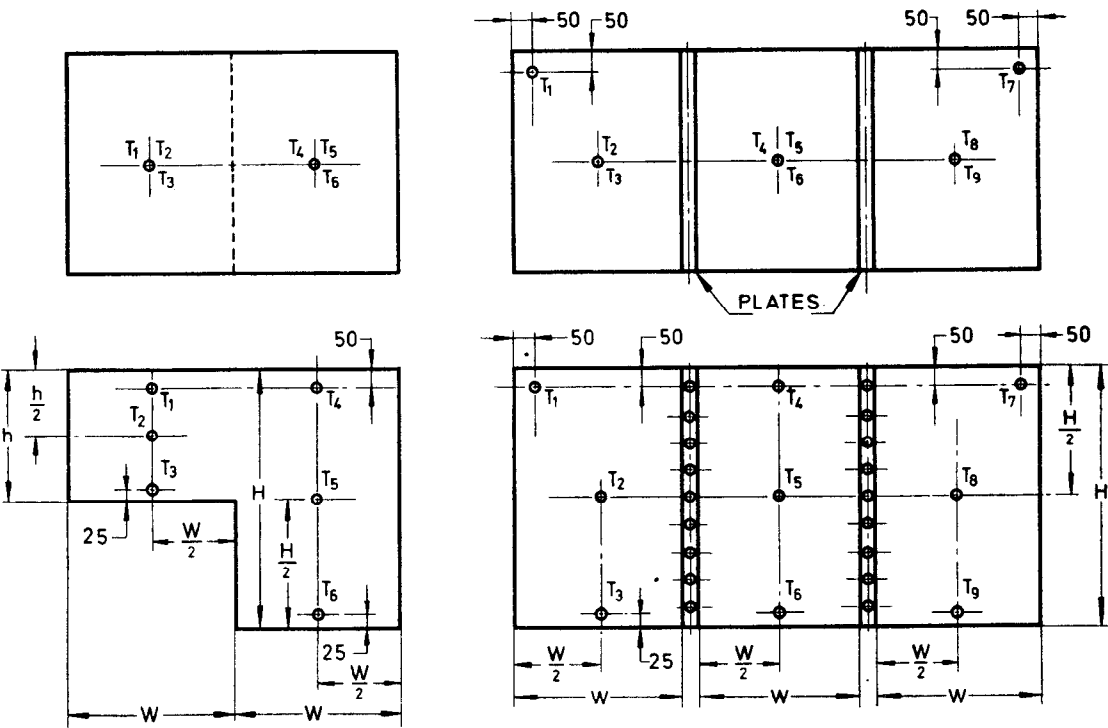
This standard was first published in 1962. It has now been revised to bring it in line with the current technical practice and to establish uniform test conditions and method to be used for determining the laboratory performance for bottle coolers. The test conditions included in the standard are intended to provide the basis for comparison of performance.

APPENDIX A
(Clause 2.6)

THERMOMETER LOCATIONS FOR TEMPERATURE MEASUREMENTS



REFRIGERATED WALL, TOP ACCESS



REFRIGERATED WALLS, TOP ACCESS

REFRIGERATED PLATES, TOP ACCESS

